

AMENDMENTS TO THE DRAWINGS

The attached annotated FIG. 10 includes a request for labeling the upper surface of the field oxide region as "115a" and the lateral boundaries as "115b₁" and "115b₂" for Examiner's approval.

Attachment: Annotated sheet showing changes

REMARKS

Claims 90 and 93-141 are pending in this application. Claim 122 has been amended. No new matter has been introduced. Applicants acknowledge with appreciation the indication in the July 7, 2006 Office Action that claims 90, 93-121 and 103-136 are allowable.

The specification has been amended to indicate that the capacitor of the present invention overlies within lateral boundaries of the field oxide region and over an upper surface of the field oxide region. The title has been amended to more clearly reflect the subject matter of the claimed invention. No new matter has been introduced.

A proposed drawing amendment for Figure 10 is submitted for the Examiner's approval. Applicants note that the corrections to Figure 10 label the upper surface of the field oxide region as "115a" and the lateral boundaries as "115b₁" and "115b₂."

In the July 7, 2006 Office Action, the Examiner indicated that "[t]he title of the invention is not descriptive" and suggested the following amended title: "CMOS imager pixel designs comprising capacitor formed entirely over and within lateral boundaries of field oxide." (July 7, 2006 Office Action at 2). Applicants respectfully note that the new title suggested in the last Office action is not clearly indicative of the invention to which all pending claims 90 and 93-141 are directed. MPEP directs that "[w]here the title is not descriptive of the invention claimed, the examiner should require the substitution of a new title *that is clearly indicative of the invention to which the claims are directed.*" MPEP §606.01 (emphasis added). In the present application, the subject matter of independent claim 122, for example, is not directed to a capacitor of a CMOS imager formed entirely over and within lateral boundaries of the field oxide. Rather, claim 122 is directed to the formation of a charge storage capacitor over a

semiconductor substrate so that one electrode of the storage capacitor is connected directly to a floating diffusion region by an electrical contact. For at least these reasons, Applicants respectfully request consideration of the new proposed amended title, as shown above.

Claims 122-129 stand rejected under 35 U.S.C. §102(b) as being anticipated by Rhodes (U.S. Patent No. 6,204,524) ("Rhodes"). This rejection is respectfully traversed.

The claimed invention relates to a method of forming a CMOS imager with improved charge storage. As such, amended independent claim 122 recites a "method of forming an imager" by *inter alia* "forming a photosensor including a charge collection region," "forming a floating diffusion region for receiving charge from said charge collection region, said floating diffusion region being connected to a gate of a pixel output transistor" and "forming a charge storage capacitor . . . so that one electrode of said storage capacitor is connected directly to said floating diffusion region by an electrical contact."

Rhodes relates to a CMOS imager that "provides improved charge storage by fabricating a storage capacitor in parallel with the photocollection area of the imager." (Abstract). According to Rhodes, "[t]he storage capacitor may be a flat plate capacitor formed over the pixel, a stacked capacitor or a trench imager formed in the photosensor." (Abstract).

The July 7, 2006 Office Action fails to recognize that Rhodes does not disclose all limitations of the claimed invention. Applicants submit that that courts have repeatedly emphasized that anticipation is established only if (1) all the elements of an invention as stated in a patent claim (2) are identically set forth (3) in a single prior art

reference.¹ Thus, the standard for anticipation or lack of novelty is strict identity. See, e.g., Novo Nordisk A/S v. Becton Dickinson & Co., 96 F. Supp. 2d 309, 312 (S.D.N.Y. 2000) (“It is not sufficient that each element be found somewhere in the reference, the elements must be ‘arranged as in the claim.’ *Lindemann Maschinenfabrik GMBH v. American Hoist and Derrick Co.*, 703 F.2d 1452, 1458 (Fed. Cir. 1984). Further, the reference must be sufficiently clear so as to prove the existence of each and every element in the reference.”); Verve, LLC v. Crane Cams, Inc., 311 F.3d 1116, 1120 (Fed. Cir. 2002) (“A single reference must describe the claimed invention with sufficient precision and detail to establish that the subject matter existed in the prior art.”); C.R. Bard, Inc. v. M3 Systems, Inc., 157 F.3d 1340, 1349 (Fed. Cir. 1998), *rehearing denied & suggestion for rehearing in banc declined*, 161 F.3d 1380 (Fed. Cir. 1998), *cert denied*, 526 U.S. 1130 (1999) (“When the defense of lack of novelty is based on a printed publication that is asserted to describe the same invention, a finding of anticipation requires that the publication describe all of the elements of the claims, arranged as in the patented device.”); Hazani v. U.S. Int’l Trade Comm’n, 126 F.3d 1473, 1477 (Fed. Cir. 1997) (“To anticipate a claim, a prior art reference must disclose every feature of the claimed invention, either explicitly or inherently.”).

In the present case, and as the case law requires, Rhodes must disclose every feature of the claimed invention. Rhodes fails to disclose, however, all limitations of claims 122-129. Rhodes does not disclose, teach or suggest “forming a floating

¹ See, e.g., Gechter v. Davidson, 116 F.3d 1454, 1457 (Fed. Cir. 1997) (“Under 35 U.S.C. § 102, every limitation of a claim must identically appear in a single prior art reference for it to anticipate the claim.”); Glaverbel Societe Anonyme v. Northlake Marketing & Supply, Inc., 45 F.3d 1550, 1554 (Fed. Cir. 1995) (“Anticipation requires identity of the claimed process and a process of the prior art; the claimed process, including each step thereof, must have been described or embodied, either expressly or inherently, in a single reference.”; “Anticipation . . . requires identity of invention: the claimed

diffusion region for receiving charge from said charge collection region, said floating diffusion region being connected to a gate of a pixel output transistor" and "forming a charge storage capacitor . . . so that one electrode of said storage capacitor is connected directly to said floating diffusion region by an electrical contact," as independent claim 122 recites. In Rhodes, storage capacitor 162, which would arguably correspond to the "charge storage capacitor" of the claimed invention, is connected to a fifth doped region 155 ("which is formed adjacent to the photogate 102") and not to the floating diffusion region 130. In addition, region 155 of Rhodes is not a "floating diffusion region . . . connected to a gate of a pixel output transistor," as in the claimed invention. Further, no electrode of the storage capacitor 162 of Rhodes is connected directly to a floating diffusion region "by an electrical contact," as in the claimed invention. For at least the reasons above, Rhodes fails to anticipate the subject matter of claims 122-129, and withdrawal of the rejection of these claims is solicited.

Claims 137-141 stand rejected under 35 U.S.C. §103 as being unpatentable over Rhodes in view of Lauxtermann et al. (U.S. Patent Pub. No. 2001/0015831 ("Lauxtermann")). This rejection is respectfully traversed.

Independent claim 137 recites a "method of forming an imager" by *inter alia* "forming a photosensor including a charge collection region," "forming a floating diffusion region for receiving charge from said charge collection region" and "connecting an electrode of a first charge storage capacitor to said floating diffusion region by a first electrical contact." Independent claim 137 further recites "connecting an electrode of a second charge storage capacitor to said charge collection region by a second electrical contact."

invention, as described in appropriately construed claims, must be the same as that of the reference, in order to anticipate.").

Lauxtermann relates to “a method for operating a CMOS image sensor including a matrix of pixels (50) arranged in a plurality of lines and columns, each of said pixels including a photosensor element (PD) accumulating charge carriers in proportion to the illumination thereof and storage means (C1,55) able to be coupled to said photosensor element (PD) at a determined instant in order to generate a sampled signal representative of said charge carriers accumulated by the photosensor, the storage means (C1, 55) being intended to assure storage for the purpose of reading said sampling signal.” (Abstract). According to Lauxtermann, “when said sampled signal, stored across said storage means is read, the photosensor element is held at a voltage such that any charge carrier generated by the latter is drained and thus does not disturb the sampled signal stored on the storage means.” (Abstract).

The subject matter of claims 137-141 would not have been obvious over Rhodes in view of Lauxtermann. Specifically, the Office Action fails to establish a *prima facie* case of obviousness. Courts have generally recognized that a showing of a *prima facie* case of obviousness necessitates three requirements: (i) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine the reference teachings; (ii) a reasonable expectation of success; and (iii) the prior art references must teach or suggest all claim limitations. See e.g., In re Dembiczak, 175 F.3d 994, 50 (Fed. Cir. 1999); In re Rouffet, 149 F.3d 1350, 1355 (Fed. Cir. 1998); Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc., 75 F.3d 1568, 1573 (Fed. Cir. 1996).

In the present case, neither Rhodes nor Lauxtermann discloses, teaches or suggests the subject matter of claims 137-141. Rhodes is silent about a “first charge storage capacitor” and a “second charge storage capacitor,” much less about “connecting an electrode of a second charge storage capacitor to [a] charge collection region by a second electrical contact,” as independent claim 137 recites. Rhodes teaches


only one capacitor structure (i.e., capacitor 162) formed overlying an active area of the pixel sensor cell, and not a first and a second charge storage capacitors, as in the claimed invention.

Similarly, Lauxtermann is silent about any of the limitations of claim 137. Lauxtermann relates to a method of maintaining constant the sampled charge stored in memory node 55 during the read process (§[0010]), and not to methods of forming CMOS imagers, much less to methods of forming CMOS imagers by the specific steps of the claimed invention. Accordingly, and for at least these reasons, the Office Action fails to establish a *prima facie* case of obviousness. Withdrawal of the rejection of claims 137-141 is also respectfully requested.

Allowance of claims 90 and 93-141 is solicited.

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Respectfully submitted,

By 

Thomas J. D'Amico

Registration No.: 28,371

Gabriela I. Coman

Registration No.: 50,515

DICKSTEIN SHAPIRO LLP

1825 Eye Street, NW

Washington, DC 20006-5403

(202) 420-2200

Attorneys for Applicants